

DIGESTIBILITY

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Digestibility

- Quantification of the digestive processes
- It is relative measure of the extent to which ingested food and its nutrient component have been digested and absorbed by animal
- The total and dry matter digestibility refers to the degree of digestibility of the complete diet
- Nutrient digestibility refers to a specific nutrient such as protein, lipid, amino acid or carbohydrate of the diet and or the ingredient

Aquaculture point of view knowledge of digestibility is important

- Method of evaluation of digestibility and of influence of age; sex, stocking density
- time and frequency of feeding and feed quality and quantity of culturable species is more important

- Only a proportion of ingested food is digested and its nutrient absorbed
- The nutritive value of a food depends not only on its nutrient content but also on the capacity of the animal to digest and absorb it
- When a formulating a diet it is essential to have a knowledge of the digestibility

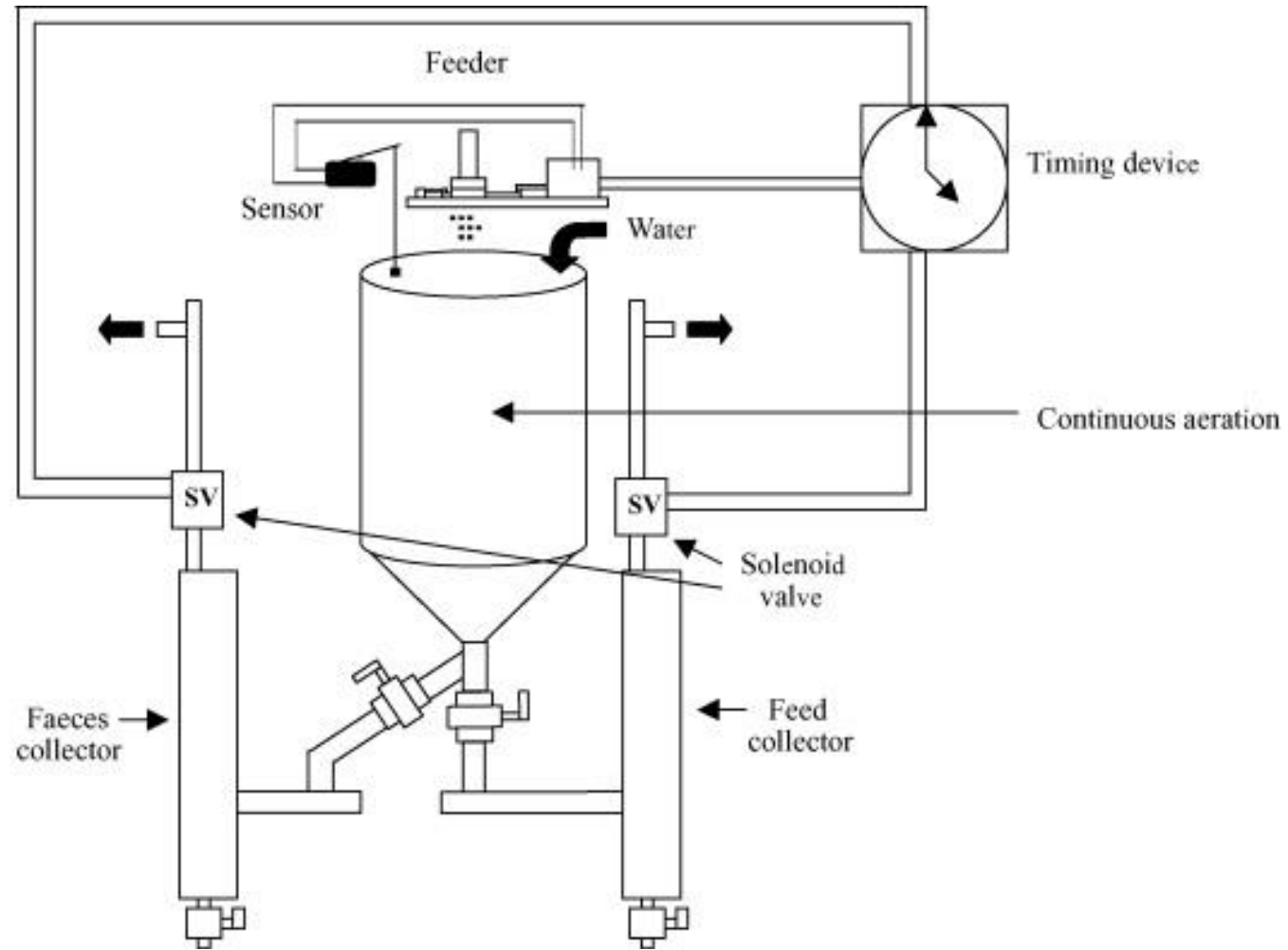
The objective of digestibility study-

- A better understanding of the potential utilization of nutrients
- An improvement in quality of food for the fish
- decrease in the waste of food & protecting the environmental & Water quality

Digestibility coefficient- quantification of digestibility

- Digestibility of diet or ingredient can be determined directly or indirectly
- **In direct method-** the quantity ingested (total or nutrient) and faecal matter voided are determined and the ratio gives the percentage digestibility of the feed or nutrient.
- It is difficult to determine total faecal matter accurately
- Leaching of nutrient from faecal matter and collection of faecal matter which break up into small particle
- Automatic continuous faecal collection devices use for collection of faecal matter
- Error due to leaching and re-ingestion of faecal matter

Automated faecal collector



Indirect method

First use by Swedish scientist Edin 1918 he use marker

Characteristic of marker –

Indigestible, use small quantity, distributed evenly in test diet or an indigestible component of diets

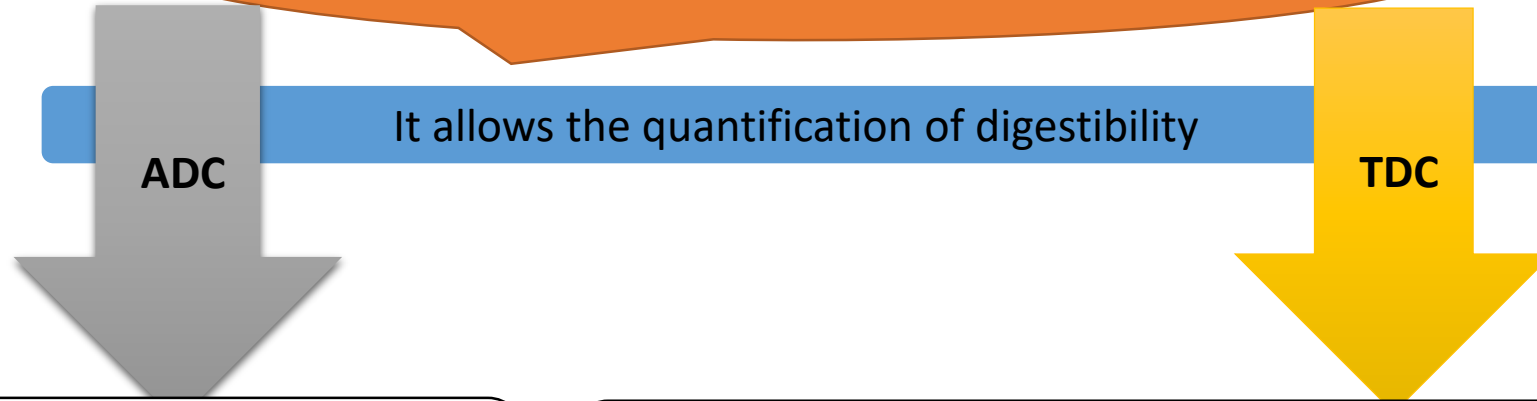
Two types of marker – **internal and external marker**

Properties of marker

- Marker will have to be indigestible
- Marker should not influence the physiology of digestion of experimental animal
- Should move into the gut at the same rate as the rest of the food material
- And should not to be toxic

- Commonly use external marker –these are introduced into the diet
Cr₂O₃; FeO; SiO₂; polypropylene etc
- Most commonly use external marker is Cr₂O₃
- Internal marker of Endogenous – commonly used for digestibility study are crude (CF), Hydrolysed resistance organic matter(HROM) and Hydrolysed resistance ash(HRA)
- CF and HROM are same group of material and cellulose and chitin are the chief component of CF.

DIGESTIBILITY COEFFICIENTS



$$\text{ingested - faecal} / \text{ingested} * 100$$

$$\text{ingested} - (\text{faecal} - \text{endogenous faecal}) / \text{ingested} * 100$$

Depends physiological state of fish & ingestion rate, allows aptitude animal to utilise a food ration to be evaluated

Mainly ADC, endogenous fraction which is low in fishes & difficult.

Depends mainly on type of diet & digestive capacity of the species, allows evaluation of suitability of a food to provide animal utilisable nutrients.

Indirect method

$$\text{ADC} = 100 - (100 \times \% \text{ marker in food} / \% \text{ marker in faeces})$$

$$\begin{aligned} &\text{The digestibility of nutrient} \\ &= 100 - (100 \times \% \text{ marker in food} / \% \text{ marker in faeces} \times \% \text{ nutrient in} \\ &\quad \text{faeces} / \% \text{ nutrient in food}) \end{aligned}$$

crude fibre(CF), Hydrolysis-resistant organic matter(HROM), and hydrolysis-resistance ash(HRA)

Cr_2O_3 , FeO, SiO_2 , polypropylene

Digestibility determination

Dry matter digestibility (%) = $100 - 100(\% \text{ marker in diet} / \% \text{ of marker in faeces})$
(total digestibility)

Nutrient digestibility (%) =

$$100 - 100 (\% \text{ marker in diet} \times \% \text{ nutrient in faeces} / \% \text{ marker faeces} \times \% \text{ of nutrient in feed})$$

Where nutrient refer to the any nutrient such as lipid protein etc

Digestibility estimation are only apparent digestibility estimation and therefore they are correctly expressed as the percentage

- Faeces are contaminated with endogenous material
- We would not estimate true digestibility
- In feed formulation and manufacturing it is essential to have a knowledge of the digestibility of the main ingredient and whole diets

Ingredient digestibility

- Prepare test diet mixing 20-30% of the ingredient to be tested with the reference diet
- Test diet(TD) : reference diet (RD) [8:2]
- **Apparent total digestibility**= $100/20\{\text{dry matter digestibility of TD} - 80/100 \text{ dry matter digestibility of RD}\}$
- Apparent Nutrient digestibility of ingredient= $100/20[\text{nutrient digestibility of TD} - 80/100 \text{ Nutrient digestibility of RD}]$

Factor influence the digestibility

- Both biological and environmental factor
- Feeding level and meal size
- Size of species and age
- Dietary component
- Types of nutrient
- Physical state of feed
- Temperature
- Salinity
- Protein energy ratio